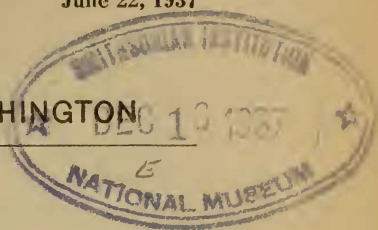


PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTONTHE DISTRIBUTION OF FLYING SQUIRRELS IN
WESTERN BRITISH COLUMBIA WITH THE
DESCRIPTION OF A NEW RACE.

BY IAN McTAGGART COWAN.

Since the publication by Howell, in 1918, of his revision of the American Flying Squirrels the number of specimens available from the Pacific northwest north of the 49th parallel has been steadily augmented. The majority of the new material comes from areas not represented in the series available at that time. It is therefore possible now to present a more detailed analysis of the variation and distribution than heretofore.

In order to carry out this study I have borrowed material from the Museum of Vertebrate Zoology through Dr. Joseph Grinnell and Dr. E. R. Hall, and from the Charles R. Connor Museum through Mr. A. S. Hyde, from Mr. J. A. Munro of Okanagan Landing, B. C., and from Mr. Kenneth Racey of Vancouver, B. C., to all of whom I wish to express my thanks.

Geographic variation in the flying squirrels of British Columbia is most apparent in dorsal and ventral coloration, amount of vinaceous or tawny in the tail, the amount of black in the tail; total body size, relative length of tail, width of tail, and in certain cranial proportions.

Within the flying squirrel population of the above described region there appear to be six well defined differentiation centres.

Southwest coastal area—*Glaucomys sabrinus oregonensis*. This area comprises the immediate coast, the lower Fraser Valley and the adjacent mountains to an elevation of about 2000 feet. The flying squirrel population is characterized by small size, relatively narrow tail, the extremely dark reddish dorsal coloration, the dusky and brownish ventral pigmentation, dark tail with much vinaceous-tawny obscured by the abundance of black tipped hairs. The skull is short and relatively broad (ratio greatest length to zygomatic width 60%), short rostrum and relatively long tooth row (ratio length of maxillary tooth row to diastema 94%). Flying

squirrels of this type are most abundant in the lower Fraser Valley, east as far as Hope but extend north at least to the lower slopes of the mountains bordering Kingcome Inlet.

Northwest coastal area—*Glaucomys sabrinus zaphaeus*. Includes the Alaskan coast adjacent to the Alexander Archipelago and north coastal British Columbia.

In external proportions there is little difference in the populations of the north and south coastal areas. The northern population, however, is characterized by its much broader tail, more tawny dorsal coloration (nearer Tawny Olive than Mikado Brown), by the brownish wash over the gray face, by the absence of any pronounced black nose and whisker spots, the reduction of the black caudal coloration so that the tail appears predominantly brown, rather than predominantly black. Underparts as heavily pigmented as in *oregonensis* but lacking the sooty infusion. The skull is of the short broad type. Squirrels of this strain probably penetrate southward along the coast of British Columbia at least as far as Gardner Canal, and unlike *oregonensis*, they extend their influence eastward onto the interior plateau. Specimens examined from Ootsa Lake though showing many characters of the Chilcotin type, tend toward *zaphaeus* in intensity of ventral pigmentation and in certain skull characters, and toward the Rocky Mountain form in length of tooth row, and length of tail.

Cascade area—*Glaucomys sabrinus fuliginosus*. In the Cascade and coastal mountains from the southern boundary of the Province north at least to the vicinity of Jervis Inlet is a population of flying squirrels sharply differentiated from that of the southern interior and that of the coastal region at low elevations by its large size (see table), extremely gray coloration, and long narrow skull (ratio zygomatic width to greatest length 57%). Of the specimens available none show intergradation with *oregonensis*. Our series of 24 specimens from British Columbia average much grayer than specimens from Washington, only 3 specimens are strictly similar to the 6 Washington specimens representing this race. Two specimens from Schoonover Mountain, Okanagan Valley, referred by Howell (Op. cit. p. 49) to *G. s. latipes*, appear to be intermediate between *columbiensis* and *fuliginosus*. They are larger and darker than typical *columbiensis*, but so far as I can discern possess no characters not readily explainable on the grounds of intergradation.

Okanagan area—*Glaucomys sabrinus columbiensis*. Okanagan Valley and adjacent mountains, north at least to Shuswap.

The flying squirrels inhabiting this area show a greater degree of color variation than is found in any other population. The majority of the specimens examined are characterized by their smaller size (see table), and lighter coloration, overwashed dorsally and ventrally with yellow. The resulting coloration is unique among British Columbia flying squirrels. Certain specimens, however, lack this yellow wash and are pale brown above, whitish below. In size and proportions the skull of *columbiensis* is identical with that of *fuliginosus* and as *columbiensis* in external measurements is smaller than *fuliginosus*, with shorter hind feet, it follows that the skull is relatively larger in the interior race. As has been mentioned above,

squirrels of this type blend into those of the *fuliginosus* type to the westward.

East central montane area—*Glaucomys sabrinus alpinus*. Rocky Mountains and mountains of eastern Cariboo and southeastern Omineca district. In the absence of topotypical material I have accepted *alpinus* as the name for the population of this region on the authority of Hall (Univ. Calif. Publ. Zool. 40, No. 9 : 374). The flying squirrels of this area have much the same cranial size and conformity as *columbiensis* and *fuliginosus*, the skulls in comparison with those of the coastal or Chilcotin populations appear long and narrow. They differ from these in usually exhibiting a marked process medially placed on the posterior palatal rim. In external proportions they are larger than *columbiensis* with longer tail and larger hind foot. Other differences between these populations is the dark, grayish ventral coloration, sometimes with brownish wash, darker tail, darker dorsal coloration and absence of yellow wash in *alpinus*.

In all these populations, with the exception of those of the coastal area, there appear occasional reddish individuals. Regardless of the race these individuals are of pale cinnamon color dorsally, white or whitish ventrally and with contrasting clear gray facial coloration.

In this color variant we perhaps see the genetic basis for the color which associated with certain pronounced cranial characters typifies the population inhabiting the Atnarko Valley, the Chilcotin Plateau and extending its influence east to Quesnel and north at least to Ootsa Lake. As this population appears to be without a name for convenient reference I here designate it as

***Glaucomys sabrinus reductus* (subsp. nov.).**

ATNARKO FLYING SQUIRREL.

Type.—Male adult, skin and skull, No. 689, Coll. of J. A. Munro; taken January, 1936, by R. A. Edwards at Lonesome Lake, B. C., on the Atnarko River, approximately 52° 10' N and 125° 45' W. Cotype female adult, skin and skull No. 692, Coll. J. A. Munro, same data as type. Type deposited in Provincial Museum.

Range.—Known only from the vicinity of the type locality and from the Chilcotin Plateau, probably has an extensive range in the Cascade region north of the range of *fuliginosus*.

Diagnosis.—A medium sized flying squirrel (average measurements of 6 individuals, 4 measured as dry skins): Total length 315 (304–323); tail 137 (120–151); hind foot 41 (39–44). Tooth row and diastema short.

Color.—In winter, color of upperparts from Drab (capitalized color terms are from Ridgway, 1912) to between Tawny Olive and Cinnamon. Undersurface of tail Light Drab to Drab Gray, occasionally of somewhat warmer tone; upper surface made dusky by many black tipped hairs. Sides of face and neck to upper side of ears clear gray; nose, whisker spot, eye ring and forward edge of ear, black. Underparts white lightly washed with yellow or yellowish brown; chin and throat white; fore and hind feet well furred, dusky above, white washed with yellowish below. Flying membranes dusky with pronounced white marginal fringe on lower side.

Skull.—Short and relatively broad, zygomatic width 60% of greatest length. Tooth row short, averaging 8.0 mm. (7.5–8.4). Posterior margin of hard palate usually concave, but occasionally with slight median eminence.

Comparisons.—From *zaphaeus* to the northward, *reductus* in winter pelage differs markedly in color, being paler, less reddish dorsally and much paler ventrally, entirely lacking pronounced tawny wash of *zaphaeus*, and having tail paler and without reddish underfur. Cranially *reductus* differs from *zaphaeus* most pronouncedly in short tooth row and long diastema, ratio of tooth row to diastema being 85% in the former, 91% in the latter.

Between *oregonensis* and *reductus* the distinctions are pronounced, the former being darker in color dorsally and ventrally with very much narrower tail; tooth row longer and diastema shorter (ratio tooth row to diastema 94% as opposed to 85%).

G. s. fuliginosus can be distinguished from *reductus* by its larger size (see table) larger skull, relatively and actually narrower (ratio zygomatic width to greatest length 57% as against 60%, much longer tooth row and longer diastema. Increase in tooth row is relatively greater than that of diastema so that ratio tooth row to diastema is 89% in *fuliginosus*, 85% in *reductus*.

In comparison with *alpinus* as represented by a large series from Bowron Lake and vicinity in the Barkerville district, *reductus* presents the following distinctive features: Dorsal coloration paler, ventral coloration markedly paler (white rather than grayish washed with brown), sides of face clear gray instead of brownish gray or sooty gray; tail lacking reddish suffusion and consequently grayish rather than reddish below. Zygomatic breadth approximately the same but skull shorter and therefore relatively broader. As in comparison with the other races the short tooth row is diagnostic. It is to be noted that the difference in greatest length of skull existing between these two races is almost completely accounted for in the anterior segment (tooth row and diastema) and in consequence though the actual difference in linear dimension is slight, the visible difference in the proportions of the cranium is great.

Since the anterior segment is known to be positively heterogonic it might be argued that the reduced size of this segment in adult *reductus* pointed to arrested development and the consequent juvenile proportions. The short tooth row, however, seems to me to mitigate against this explanation as do the external dimensions of the race, which are greater than is the case in the coastal races to the north and south.

Remarks.—The combination of characters described above as typical of the race *reductus* in so far as can be ascertained from specimens at my disposal is best developed in the vicinity of Lonesome Lake. Squirrels of the same type will doubtless be found to inhabit the heavily wooded and almost unexplored mountain ranges to the north and south. Specimens from Chezacut and Anahim in some instances have a pronounced brownish wash over the underparts but are still referable on grounds of cranial characters to *reductus*.

One specimen from Anahim is externally almost indistinguishable from

Indianpoint Lake specimens of *alpinus*. At the same time two specimens from Indianpoint Lake closely approximate the average coloration of Chilcotin specimens.

Specimens examined.—All from British Columbia except where otherwise stated.

G. s. reductus: Lonesome Lake 5; Anahim 2; Chezacut 6; ¹Quesnel 2.

G. s. alpinus: Indianpoint Lake 10, ¹Stuart Lake 2, ¹Ootsa Lake 3; skulls only, Cunningham Creek 24, Ahbau Lake 2, Bowron Lake 2, Lightning Creek 2.

G. s. zaphaeus: Helm Bay 4; Bradfield Canal 1; Etoin Island 1; Wrangel 5.

G. s. oregonensis: Huntingdon 2; Dollarton 1; Sumas Prairie 1; North Vancouver 1; Aldergrove 1; Vedder Crossing 1; Vedder River 2.

G. s. fuliginosus: Alta Lake 15; Cheakamus Lake 3; Blackwater Lake, Lillooet District 1; Seton Lake 1; Lillooet 4. From Washintgon: Mt. Adams, Twin Lakes, Whatcom Co.; Mt. Baker, Whatcom Co.; Owhigh Lakes, Pierce Co.; Glacier Basin, Pierce Co.; Goose Prairie, Yakima Co.

G. s. columbiensis: Okanagan 8; Okanagan Landing 2; Shurtleworth Creek, Okanagan Falls, 1; Schoonover Mountain 2; Grand Prairie 1; Shuswap 1; Broadwater 1; Lumby 2.

¹ Indicates specimens exhibiting the effect of intergradation with adjoining races.

MEASUREMENTS OF FLYING SQUIRRELS FROM BRITISH COLUMBIA AND ALASKA.

	Total length	Length of tail	Width of tail	Length of hind foot	Greatest length of skull	Zygomatic breadth	Mastoid breadth	Greatest length of nasals	Length of maxillary tooth row	Diastema	Ratio greatest length to zygomatic width	Ratio tooth row to diastema	Number of specimens (external)	Number of specimens (cranial)
<i>oregonensis.</i>														
Mean.....	303	142	50	39	40.7	24.3	18.7	12.6	8.4	8.9	60%	94%	6	5
Minimum.....	264	128	48	36	39.3	23.5	18.4	12.0	7.8	8.5				
Maximum.....	325	152	53	41	42.0	25.4	19.1	13.4	9.0	9.4				
<i>zaphaeus.</i>														
Mean.....	312	145	58	41	41.3	25.1	18.8	12.8	8.3	9.1	61%	91%	5	7
Minimum.....	300	141	50	40	38.9	24.0	17.8	12.2	7.8	8.3				
Maximum.....	331	150	65	44	42.1	26.0	19.1	13.5	8.6	9.6				
<i>fuliginosus.</i>														
Mean.....	337	149	55	42	42.1	24.1	19.1	13.3	8.9	10.0	57%	89%	10	10
Minimum.....	304	127	45	40	41.0	22.9	18.3	12.5	8.5	9.6				
Maximum.....	380	165	60	44	43.5	24.8	19.8	14.6	9.6	10.5				
<i>columbiensis.</i>														
Mean.....	316	142	55	39	42.3	24.2	18.9	13.1	8.5	9.7	57%	88%	13	8
Minimum.....	290	130	49	32	38.9	23.7	18.5	12.0	8.0	8.7				
Maximum.....	340	165	60	42.5	43.0	24.7	19.5	14.0	9.0	10.4				
<i>alpinus.</i>														
Mean.....	334	154	60	42	42.0	24.7	19.4	13.2	8.6	9.7	59%	89%	7	30
Minimum.....	311	143	52	40	40.0	23.8	18.4	11.7	7.8	9.0				
Maximum.....	366	166	66	45	44.1	25.9	20.6	14.6	9.5	10.8				
<i>reductus.</i>														
Mean.....	315	137	58	41	40.8	24.6	19.4	12.5	8.0	9.4	60%	85%	6	8
Minimum.....	304	120	50	39	40.0	23.0	18.9	11.8	7.5	9.1				
Maximum.....	323	151	65	44	41.7	25.4	20.0	13.0	8.4	9.6				